

Claims

1. Safety belt apparatus for vehicles, in particular motor vehicles having at least one safety belt (11), which is wound to a greater or lesser degree onto a belt reel (13) rotatably secured on the vehicle chassis (14) about an axis of rotation (12) and preferably biased by a spring retraction mechanism, in particular a spiral spring (15) in the belt winding up direction and/or having a belt draw out blocking mechanism (26, 38; 55, 56, 57) which, with an attempted rapid draw out of the safety belt (11) and/or with in particular accident dependent accelerations and/or deviations of the vehicle position from the normal, horizontal arrangement of the vehicle, blocks a further draw out of the safety belt (11), with a toothed ratchet wheel (29) being rotationally coupled to the belt reel (13), preferably with a small rotary clearance and cooperating with a blocking pawl (17) secured to the housing and movable into an out of engagement, in such a way that with the blocking pawl (17) moved into engagement with the toothed ratchet wheel (29), a rolling up movement of the belt reel (13) by the spring retraction mechanism (15) is possible, but not a pulling out of the safety belt (11), and wherein, when the blocking pawl (17) is located in engagement with the toothed ratchet wheel (29), the toothed ratchet wheel is preferably rotatable against a spring force relative to the belt reel (13) within the rotary clearance and can bring a control pawl (61) attached to the belt reel (13) into engagement with a toothed ring (65) fixed to the housing, with the blocking pawl (17) being movable into and out of engagement with respect to the toothed ratchet wheel (29) by a cam ring (18) concentric to the belt reel axis (12) via a step down transmission (20, 21, 27, 28) so that the blocking pawl (17) is moved out of engagement

with a safety belt (11) which is drawn in to a greater or lesser degree and preferably at least fully drawn in and is movable into engagement with a further drawn out safety belt (11), preferably with a largely fully drawn out safety belt (11), wherein a toothed control wheel (21) is connected to the belt reel (13) via an eccentric transmission (27, 28) and has at its periphery a preferably wave-like arrangement of teeth (40), which is surrounded by an inner toothed ring (20) fixed to the housing of larger diameter and with complementary teeth (41), but with a smaller or preferably larger number of teeth, such that the toothed control wheel (21) stands in meshing arrangement with the inner toothed ring (20) over a restricted peripheral region and the two arrangements of teeth (40, 41) have a radial spacing diametrically opposite thereto such that the toothed control wheel (21) rolls off on the inner toothed ring (20) on rotation of the belt reel (13), and wherein the total draw outlength of the safety belt (11) corresponds to an angle of rotation of the toothed control wheel (21) relative to the axis of rotation (12) of less than 360° and in particular of substantially 180° , characterized in that

the toothed control wheel (21) is rotationally fixedly connected to the cam ring (18), but radially displaceable in the context of its eccentric movement, with the cam ring (18) having switching means (46, 47) along a first angular region (45) for the engagement and disengagement of the blocking pawl (17), and at least one switching element (49) along a second angular region (48) for at least one further belt draw outdependent switching operation.

2. Safety belt apparatus in accordance with claim 1, characterized in that
the switching element is a switching cam track (49) and actuates a micro-switch (50) fixed relative to the housing for the activation of a belt tensioner (35) after a predetermined draw outlength of the safety belt (11) from the fully drawn in state.
3. Safety belt apparatus in accordance with claim 1 or 2, characterized in that
the cam ring (18) has a part right cylindrical circumferential surface (51) along the first angular region (45) at the ends of which in the peripheral direction preferably radially outwardly projecting abutment steps (46, 47) are provided, which cooperate with a switching arm (52) of a rocker element (53) acting on the blocking pawl with two over-dead center positions such that the one abutment step (46), on striking the switching arm (52), pivots the rocker element (53) into the position which brings the blocking pawl (17) into engagement with the toothed ratchet wheel (29), and the other abutment step (47), on striking the switching arm (52), pivots the rocker element (53) into the position which brings the blocking pawl (17) out of engagement with the toothed ratchet wheel (29).
4. Safety belt apparatus in accordance with claim 3, characterized in that
the abutment step which becomes active during the drawing in of the belt strikes against the switching arm (52) of the rocker element (53) when the safety belt (11) is not fully drawn in, and in that the switching arm (52) subsequently lies adjacent or against a prefera-

bly part right cylindrical peripheral surface (54) with a radius greater by the height of the abutment step (47).

5. Safety belt apparatus in accordance with claim 3 or 4, characterized in that the abutment steps (46, 47) have an angular spacing of 120° to 160° , preferably 130° to 150° , and in particular of about 140° .
6. Safety belt apparatus in accordance with one of the preceding claims, characterized in that the first angular range (45) amounts to 180° to 220° , preferably 190° to 210° , and in particular to about 200° .
7. Safety belt apparatus in accordance with one of the preceding claims, characterized in that the second angular range (48) amounts to 140° to 180° , preferably 150° to 170° , and in particular to about 160° .
8. Safety belt apparatus in accordance with one of the preceding claims, characterized in that the cam ring (18) has a central bore (19) rotatably journalled on a central hollow bearing spigot (16) fixed relative to the housing, within which the hub (58) of an eccentric disc (27) is preferably rotationally journalled, and is preferably arranged concentric to the belt reel (13).

9. Safety belt apparatus in accordance with one of the preceding claims,
characterized in that
a driver pin (24) extends from the cam ring (18) into a driver recess (23) of the toothed control wheel (21) complementary to it in the peripheral direction, with the driver recess having a radial extent such that the driver pin (24) can be freely radially displaced therein during the eccentric movement of the toothed control wheel (21), with it also being possible to provide the driver pin on the toothed control wheel and the driver recess on the cam ring.
10. Safety belt apparatus in accordance with one of the claims 2 to 9, characterized in that
an actuating plunger (22) of the micro-switch (59) cooperates with the switching cam track ((49) in such a way that the micro-switch (50) deactivates the belt tensioner (35) when the safety belt (11) is drawn in and over a restricted draw out range adjoining it and activates the belt tensioner with a draw out which goes beyond the restricted draw out range.
11. Safety belt apparatus in accordance with claim 10, characterized in that
the actuating plunger (22) is thrust radially outwardly by the switching cam track (49) against the spring force (59) when the safety belt (11) is drawn in and, on the far side of the restricted draw out range, is shifted by spring force (59) onto the switching cam track (49) which drops away radially inwardly.
12. Safety belt apparatus in accordance with one of the claims 2 to 11,

characterized in that

the belt tensioner is activated by the micro-switch (50) after a belt draw out of 400 mm to 800, preferably 50 mm to 700, and in particular of about 600 mm.

13. Safety belt apparatus in accordance with one of the preceding claims,

characterized in that

when the belt is drawn in from the fully drawn out state up to a drawn out belt length of 400 m to 800, preferably 500 mm to 700 mm, and in particular about 600 mm, only a belt draw in is possible, but not a belt pull out, and in that with a greater belt draw in the blocking pawl (17) is brought out of engagement with the toothed ratchet wheel (29) and the belt tensioner is simultaneously deactivated.

14. Safety belt apparatus for vehicles, in particular motor vehicles having at least one safety belt (11), which is wound to a greater or lesser degree onto a belt reel (13) rotatably secured on the vehicle chassis about an axis of rotation (12) and preferably biased by a spring retraction mechanism, in particular a spiral spring (15) in the belt winding up direction, and having a belt draw out blocking mechanism (26, 38), which, with an attempted rapid draw out of the safety belt (11), blocks a further draw out of the safety belt (11), with a toothed ratchet wheel (29) being rotationally coupled to the belt reel (13) with a small rotary clearance (77) and being so spring biased in the belt unwinding direction of rotation of the belt reel (13) relative to the latter that it is located in the biasing direction at the end of the rotary clearance (77), wherein, when the belt draw out blocking

mechanism (26, 38) becomes effective and the tension force is maintained at the safety belt (11), an engageable pawl 61 mounted on the belt reel (13) is brought into engagement with a ring of teeth (65) secured to a housing, whereupon a further draw out of the safety belt (11) is stopped, in particular in accordance with one or more of the preceding claims,

characterized in that

the draw out blocking mechanism has a rotary acceleration lever (38) pivotable about a pivot axis (68) extending parallel to the belt reel axis (12), and having, at one end, at least one blocking tooth (69), which, on pivoting of the rotary acceleration lever (38), can be brought into or out of engagement with an inner toothed arrangement (26) of a toothed ring support member (25) arranged fixed relative to the housing preferably concentric to the toothed ratchet wheel (29), wherein the rotary acceleration lever (38) is normally held out of engagement with the inner toothed arrangement (26) by a resetting spring (70), but comes into blocking engagement with the inner toothed arrangement (26), with rotary accelerations in the belt draw out direction above a predetermined rotary acceleration boundary value.

15. Safety belt apparatus in accordance with claim 14, characterized in that the rotary acceleration lever (38) has two lever arms (38', 38"), of which the one is provided with the blocking tooth (69), and the other is arranged relative to the pivot axis (68) such that it exerts a torque onto the rotary acceleration lever (38) in the blocking direction, with rotary accelerations in the belt draw out direction, which leads above the predetermined rotary acceleration limit value to a

rotation of the rotary acceleration lever (38) against the force of the spring (70) in the blocking direction.

16. Safety belt apparatus in accordance with claim 14 or 15, characterized in that the two arms (38', 38'') of the rotary acceleration lever (38) are shaped and are provided with mass such that a torque is only exerted on the rotary acceleration lever (38) by rotary acceleration, but not by rotary speeds.
17. Safety belt apparatus in accordance with one of the claims 14 to 16, characterized in that the abutments (71, 72, 73, 74, 75) restrict the pivotal movements of the rotary acceleration lever (38).
18. Safety belt apparatus in accordance with one of the preceding claims, characterized in that a curved elongate hole (76) is provided in the toothed ratchet wheel (29) extending substantially radially with a peripheral component and receives a guide spigot (62') concentric to the axis (63) of the engageable pawl (61); and in that the engageable pawl (61) is rotatably mounted on the belt reel (13) preferably radially inwardly of the guide spigot (62') about an axis (63) which extends parallel to the axis (12) of the belt reel (13).
19. Safety belt apparatus in accordance with one of the preceding claims, characterized in that the number and arrangement of the teeth of the inner toothed arrangement (26) and of the inner toothed ring (65) are selected relative to one another such that on blocking of the rotation of the toothed ratchet wheel (29) by engagement of the blocking tooth (69) into the inner toothed arrangement (26), the teeth (64') of the engageable pawl (61) are aligned with the tooth recesses (65) in the peripheral direction in such a way that with a

relative rotation between the belt reel (13) and the stationary toothed ratchet wheel (29), a problem-free engagement of the teeth (64') into the tooth recesses (65') is ensured.

20. Safety belt apparatus in accordance with one of the preceding claims, characterized in that the rotary clearance spring (67) is so strongly made that the toothed ratchet wheel (29) is driven with the same speed of rotation of the belt reel (13) with the normally arising rotary accelerations of the belt reel (13) in the belt draw out direction and in that the rotary clearance (77) is first overcome against the force of the rotary clearance spring (67) when the blocking tooth (69) is engaged into the inner toothed arrangement (26).